Ontario. Legislative assembly. [Committees]
Select committee on Toll Roads
Preliminary feasibility report of Ontario turnpike, Windsor - Fort Erie, Ontario, October, 1954.

ONTARIO



# PROCEEDINGS

OF THE

SELECT COMMITTEE APPOINTED BY THE LEGISLATURE OF THE PROVINCE OF ONTARIO, TO ENQUIRE INTO AND REPORT UPON MATTER IN CONNECTION WITH TOLL ROADS IN THE PROVINCE.

Mr. J. P. Robarts, Q.C., Chairman,
Presiding.

Mr. D. J. Collins, Secretary.

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PRELIMINARY FEASIBILITY REPORT OF ONTARIO TURNPIKE

Windsor - Fort Erie, Ontario.

October, 1954.

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R. C. Sturgeon,
Official Reporter,
Parliament Buildings,
Toronto, Ontario.

October 30, 1954

Captain Joseph Jeffery,
c/o Jeffery and Jeffery,
London, Ontario.

Dear Captain Jeffery:

In accordance with our recent discussions, we have made a preliminary study of the feasibility of a toll highway across the Province of Ontario, linking the Fort Erie - Buffalo area in the east with the metropolitan centers of Windsor and Detroit in the west.

The results of our study are set forth in the Preliminary Feasibility Report presented herewith. The 220-mile route appears to be a most logical and obvious location for a modern turnpike facility. An investment of approximately $152 million is estimated to build the road; our studies further show that this investment could be amortized completely through tolls in 20 years of operation.

It should be emphasized that this Report is preliminary in nature; we have analyzed all available data pertinent to the project in question, and have drawn heavily on our experience with similar turnpike projects in the United States. However, we have made an effort to be conservative and feel that a more detailed and exhaustive study could only prove more conclusively the feasibility of this project.

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# PRELIMINARY FEASIBILITY REPORT ON THE ONTARIO TURNPIKE WINDSOR - FORT ERIE OCTOBER, 1954

## I. INTRODUCTION

The purpose of this report is to record the results of preliminary engineering and location studies and to present recommended designs and cost estimates to determine the economic feasibility of the proposed Ontario Turnpike extending from Windsor to Fort Erie.

In order to evaluate the factors determining the selection of the most satisfactory route, two alternate routes were chosen which would serve the most traffic and be economically justified. These routes were determined primarily through use of Canadian Geological Survey topographic maps of the area and a reconnaissance survey of the routes. Although both locations will be described in detail in subsequent sections of this report, the Northern Route (see figure 10) was selected for estimating purposes as this route better reflects factors and conditions confronting the engineer in design and construction.

This limited access highway will be as near to an ideal highway as possible. Throughout its length it will be a completely divided highway. Adequate

lanes of travel will be available in both directions to accommodate present and future requirements.

The alignment of the turnpike will consist of moderately long tangents and gentle sweeping curves so arraged as to:

Overpass or underpass all sideroads and railroad tracks.

By-pass all populated areas.

Take advantage of the natural terrain.

Overpass existing waterways.

Have interchanges easily accessible so as to best serve the adjacent communities, the varied interests of the area and traffic of the Province as a whole.

Travel will be safer due to the wide median which not only eliminates the possibility of accidents from opposing traffic but improves night driving conditions by screening opposing headlights almost completely. Parking on the right of the highway will be available on wide stabilized shoulders. Throughout the entire length of the turnpike, easy flat grades will be employed, providing quick and safe transporation for pleasure and commercial traffic alike.

The turnpike will be financed through the sale of revenue bonds and the amortization of the

bonded debt will be dependent on the amount of traffic using the Turnpike. Turnpike traffic will consist of trucks and passenger cars diverted from longer, more congested routes. In addition, the highway will generate additional traffic not previously existent which will use the new facility because of the added convenience, comfort, safety, and savings in time and distance. Consequently, flat grades, curves and directness of route are of extreme importance to the person paying toll for fast, comfortable travel afforded by the superhighway. These aspects have been given careful attention in the design and location studies which have been made and summarized in this report.

# II. HIGHWAYS AND VEHICLES

The continued rapid industrial, commercial and agricultural growth of Southern Ontario demands that the best transportation facilities be provided and, in fact is largely dependent upon them. In the early history of motor transportation, speeds were slow and vehicles were few in number; consequently it was not difficult for highway construction to keep up with the needs of the motorists. Now, the situation is vastly changed. Vehicle speeds have greatly increased and the automotive industry has grown to proportions which were not foreseen.

In an attempt to correct the ever growing traffic problem, the Canadian Provinces, which bear the greatest responsibility for roads, spent $2,311,000,000 for construction and maintenance during the period from 1945 to 1952, inclusive. However, only thirty (30) percent of the highways are surfaced, a small portion of which are high standard roads. Highways which were intended to serve industrial and residential progress are now totally inadequate.

## Highways

Between Windsor and Fort Erie, the principal highways are Routes 2 and 3. Although these routes

[illegible]

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[illegible] are Tables 2 and 3. Although [illegible]

were adequate when built, the needs of modern traffic are not fully satisfied by such older highways. These needs have so far outstripped the limited funds available for improvements that progress is necessarily slow. As fast as portions of a highway are improved, roadside business developments create congested conditions unsuitable to high speed through traffic. The need for a limited access facility is thus heightened rather than lessened.

Provincial highways, constructed and maintained as they are by the general motoring public, must serve the majority of those who support them. This is only proper. The expenditure of tax revenues for highways which do not best serve the interest of those located along them could hardly be justified. Therefore, they must provide for local traffic as well as through traffic. Serving this local traffic very seriously reduces the utility of the highway for through traffic using the same highway. It is almost impossible to combine these two important functions.

To serve local traffic on a free highway, motor vehicles must be permitted to enter and leave the highway at frequent intervals. Furthermore, crossings of the median strip are provided at intervals to allow the driver to make a U-turn. Therefore, in the interest

of safety, it becomes necessary to restrict speed along the highway wherever cross traffic exists.

The existing Provincial Routes 2 and 3 between Windsor and Fort Erie consist mainly of two-lane roadway with generally limited sight distance, especially on vertical curves; thus passing opportunities are only infrequently afforded with present traffic volumes. Oncoming cars often prevent safe passing even when a clear sight distance reveals a stretch of roadway ahead.

Other factors resulting in low average speeds are traffic lights and reduced speed zones, many of them 25 and 30 miles per hour. These are all necessary as long as the road serves its dual function of handling both local and through traffic.

## Turnpike Advantages

The design features of a modern limited access highway represents the results of many years of experience gained by engineers in their quest for the maximum in driving safety and comfort. The most important of these features are:

1. A minimum of two traffic lanes in each direction.
2. Adequate separation of opposing traffic.
3. Grade separations at all intersections.
4. Control and restriction of roadside culture.
5. Restriction of access to specific points.

Highways incorporating these features provide the motorist with a fast, safe facility geared to modern vehicles. Access to the facility is limited; interchanges provide a minimum of interference with through traffic; crossings at grade are eliminated; curves and gradients are reduced; and stop signs and traffic signals are nonexistent. The restriction of advertising and other property from encroaching on the right-of-way increases driving comfort. All these factors contribute to safety and a smooth flow of traffic.

Because of their modern construction, toll roads provide an efficient means of handling traffic, especially in highly traveled areas. They lessen vehicular delay and congestion, promote safety, economy and ease of operation. Statistics indicate that fatality rates on certain toll roads are one-fourth as great as on parallel free routes.[1] In addition to the economies of safety, toll roads offer significant savings in vehicle operating costs as a result of lesser curvature and gradient and the practical elimination of starts and stops. A study conducted to determine why motorists chose a superhighway over an alternate route found that of the drivers questioned,

1. M. V. Roberts, "Toll Highways: The Florida Proposal", Bureau of Economic & Business Research, University of Florida, Gainsville, Florida, December - 1952.

thirty-eight per cent saved distance by using the superhighway but eighty-one per cent saved time. In other words, forty-three per cent of the motorists were willing to take a longer route if it saved time.[2] Furthermore, nineteen per cent of those questioned indicated that they preferred the superhighway, even though they saved neither mileage or time, indicating a preference for greater driving comfort which the toll road afforded. Trucks, especially, realize great savings in the use of toll roads. By using the Pennsylvania Turnpike instead of paralleling free roads, truckers report that they save twenty-five per cent in gasoline and forty per cent in time.[1] It is easily understood why trucks furnish three-fifths of the tolls collected on this turnpike.

Financially, toll roads have a number of features which have made them especially attractive in recent years and which should be equally applicable to the Province of Ontario:

1. They can be built at no cost to the taxpayers of the Province, since the revenues from the roads are sufficient to cover costs and amortize the original investment.
2. Toll roads can be constructed without taking money from the regular highway funds of the

Province. The latter can then be used to build and maintain other roads.

3. Once in operation, toll roads divert traffic from other highways, reducing the aggregate maintenance costs of all highways to the Province.

Perhaps one of the most convincing arguments for the toll road, however, is its practicability. The need for improved arterial highways is so great as to exceed the available financial resources of the Province. If general highway revenues are lacking and borrowing power is limited, toll roads represent the only practical solution to the demand for new highway facilities to relieve congestion on heavily traveled routes. Recognition of this fact has prompted the governing bodies of many states to enact legislation authorizing the construction of toll roads.

As mentioned elsewhere in this report, southern Ontario is a "bridge" for a great deal of through passenger and truck traffic in the northeastern United States. On the Pennsylvania Turnpike, out-of-state users represent forty per cent of all vehicles and furnish

1. Highway Research Board, Report 9-A, Washington, D. C. 1950.
2. D. L. Trueblood "The Effect of Travel Time and Distance on Freeway Usage, "Public Roads", February, 1952. Although this study concerns the use of a freeway, the results would be equally applicable to any modern arterial

half of all revenues. There is every reason to believe that nonresident traffic on arterial highways in southern Ontario approaches the proportion on Pennsylvania's main routes.

Another important advantage of a toll highway is the fact that it can be constructed and put into service in a minimum of time, usually in three years or less, Even if it were feasible to construct a similar high-speed highway with tax funds, it would take many years to secure the necessary financial resources to bring it to completion.

Toll Road Trends

The growth and success of toll highways has been phenomenal. Some 1,150 miles of toll roads are now in service; 1,400 additional miles are under construction, another 3,700 miles are authorized, and nearly 2,650 more miles are projected. This growth has occurred chiefly since the end of World War II.

The first 160 miles of the Pennsylvania Turnpike were completed October 1, 1940. Great doubt was expressed at that time as to whether or not it would be a success. However, traffic volume and revenues exceeded all expectations and led to the extension of the turnpike since 1948 eastward 100 miles to King of Prussia and westward 67 miles to the Ohio State Line.

Eastward from King of Prussia the 32 mile Delaware River Extension is now nearing completion of construction to the New Jersey line where it will connect with the New Jersey Turnpike.

Westward, Ohio and Indiana are undertaking the extension of this major traffic artery by constructing a toll highway across each state to the Illinois line.

Traffic on toll highways, wherever put in operation - in Pennsylvania, Oklahoma, Colorado, New Jersey, New York, Maine, and New Hampshire - has always exceeded predictions upon which the feasibility reports were based. In Pennsylvania, Turnpike traffic volumes exceeded, by far, that which had previously existed on the excellent parallel free highway, U. S. Routes 30 and 22.

The New Jersey Turnpike bonds may be paid off nearly 30 years sooner than expected if present traffic rates continue. Revenues during the first two years of operation were more than double the engineers' estimates. Traffic in 1953 was almost triple the predicted volume: it equaled the volume expected in 1975. Truck traffic constitutes a steadily increasing percentage of total traffic. 1953 truck traffic showed a gain of almost 60% over 1952. Several extensions to this turnpike

system are planned and one is already under construction. This is a direct consequence of the turnpike's extra ordinary success.

On the Maine Turnpike, gross revenue for 1953 exceeded the sum estimated for 1969. A 66-mile extension to Augusta is now under construction.

Similarly, revenues of the Turner Turnpike in Oklahoma for the first eight months of operation exceeded the engineers' estimates by 30%.

Another western turnpike, the Denver-Boulder Turnpike, has produced excellent revenues: for the 1953 fiscal year, toll revenues were $414,343, which exceeds the $400,000 revenue estimated by engineers for the year 1980. The 1953 revenues were more than 50% greater than the engineers' estimate.

Traffic volumes on all turnpikes have shown a greater percentage increase than the average growth for all toll free state routes. This may be ascribed to what is termed "induced traffic" or traffic generated by the new highway which did not previously exist in the area.

Truck Trends

For the transportation of freight by all types of carriers, the trucking industry is steadily gaining a growing percentage of all revenue. The motor truck

share of all freight revenue in the United States rose from 15.9% in 1944 to 28.8% in 1952, according to the 1953 annual report of the Interstate Commerce Commission. Indications are that the trend will continue. The advantages of operating over a modern superhighway are especially attractive to truckers, particularly to operators of the heavier tractor-trailer combinations.

As shown by figures 1 and 2 heavy truck combinations (i.e. tractor-trailers, etc.) are accounting for a constantly increasing percentage of all vehicle-miles and ton-miles traveled in the United States and Canada.

The following is quoted from "A Factual Discussion of Motor Truck Operation, Regulation and Taxation", a statement submitted (June 1950) by the Commissioner of the Bureau of Public Roads to the Committee on Interstate and Foreign Commerce of the United States Senate: "Apart from the great increase that has occurred in the numbers of vehicles and the total volume of traffic, the most significant changes that have occurred in the Nation's motor vehicle equipment and in the use of its roads, in recent decades, have been:

1. The relatively greater increase of commercial vehicles, both in the registration and in the

traffic stream, in comparison with passenger automobiles.

2. Among commercial vehicles, the relatively greater increase of combination vehicles in comparison with single-unit vehicles.
3. A constant increase in the size and the pay load and gross weight of the combination vehicles, particularly.
4. A marked tendency in the loading of commercial vehicles, and particularly the combination vehicles, to overleap the limits of vehicular weight established by State law, and more alarmingly, to overload the existing highways."

These facts are most significant in evaluating future revenues for any turnpike since heavy trucks contribute a large share of the revenue. The effect is to increase the average truck revenue per mile, providing an added safety factor in income computations; traffic and revenue estimates later in this report are conservative in that a constant average rate per truck mile has been used. The unmistakable trend toward an increasing average rate, due to the higher proportion of heavy trucks, will provide extra revenue over and above the estimates.

Further evidence of this trend is found in a

1952 Truck-Size-and-Weight study by the Colorada State Highway Department. Since loadometer operations were started in 1936, a large increase has been noted in the weight of combination vehicles as against that of single trucks. Average weight of single-unit trucks in 1936 was 7,400 lbs. compared with 7,700 lbs. in 1952, while the average weight of combination vehicles increased from 22,700 lbs. to 41,300 lbs. during the same period. Combinations were equipped with 319 axles per 100 vehicles in 1936 and with 398 axles per 100 vehicles in 1952. The same study showed that the percentage of combinations tripled in the same period, in relation to total traffic.

According to the Dominion Bureau of Statistics, the volume of freight carried on Ontario highways has doubled in the past eight years. The number of motor transports with a gross loaded weight of five tons or more rose between 1945 and 1953 by 126 per cent, and those of 10 tons or more by 883 per cent.

Nationwide statistics[1] show that in the period 1936-1952 traffic volume increased 97 per cent, but commercial traffic increased 158 per cent and the average weight of loaded trucks about 95%. We assume

1. Report presented at the thirty-first annual meeting of the Highway Research Board, January 14-18,1952, Washington, D.C.

that these figures would be applicable to a considerable degree in the Province of Ontario. This continuing trend contributes materially to the prospects for successful turnpike operations, both physical and financial. Physically, the turnpike's special heavy-duty construction and high-speed design will offer maximum utility to the user; financially, trucks will provide a major share of revenue, as on other turnpikes.

Safety

According to the Dominion Bureau of Statistics, Ontario Traffic deaths increased to 1082 in 1953, injuries to 24,353. This is a rise of 72 fatalities from 1952. Property damage amounted to $24.3 million, up nearly $4 million from the previous year.

Data on turnpike safety are provided by the 1951 California highway vital statistics:[1] for limited access superhighways (freeways) the traffic volume is 13 times that of the average rural state highway, yet the accident rate is only about half and the fatality rate is only about one-fifth that of conventional highways. These data are presented below:

| | ACCIDENT RATE |
|---|---|
| Rural State Highways | 2.71 per million vehicle miles |
| Freeways | 1.51 per million vehicle miles |

[1]California Highway and Public Works, Vol.31, No.11, 12, p. 31, Nov.-Dec.,1952.

FATALITY RATE

| | |
|---|---|
| Rural State Highways | 11.39 per 100 million vehicle miles. |
| Freeways | 2.54 per 100 million vehicle miles. |

Despite the higher speeds, studies conducted by the U.S. National Safety Council revealed that during the six-year period from 1941 to 1946, the death rate per hundred million vehicular miles on the Pennsylvania Turnpike with a 70-mile speed limit was 10.85, as contrasted with 14.1 for rural Pennsylvania Highways with a 50-mile speed limit. It might be added that the 1952 fatality rate on the turnpike was 7.3, with a comparable rate for 1953.

Nationwide data are presented in Figure 3. In the absence of information to the contrary, and without conducting a detailed study of the subject in Canada, we feel it reasonable to assume that these figures would be applicable to some degree in the Province of Ontario.

## III. LOCATION OF THE TURNPIKE

Three of the most heavily traveled roads in the Province of Ontario are Provincial Routes 2 and 3 and the Queen Elizabeth Way. These routes serve a large population in the Province, Route 2 terminating at Windsor and Hamilton; Route 3, Windsor and Fort Erie; and the Queen Elizabeth Way, Hamilton and Fort Erie. Enroute, they serve the populous communities of London, St. Thomas, Brantford and Niagara Falls. Industrially and population-wise, this area is growing rapidly and will have increasing needs for fast and safe automotive intercommunication.

### Description

As previously mentioned, two alternate routes were selected for consideration. The general location of these routes appear on the strip map, Figure 10. In either case, the route to be traversed by the turnpike is located along the axis of Route 2 and the Q. E. Way in the north and Route 3 in the south. As such, the general location of the Ontario Turnpike is extremely well suited to meet the needs of a vast area of southern Ontario and the eastern United States.

The description of the initial section of the turnpike between Windsor and London will apply to both alternate routes as only one location was considered

feasible in this area. The turnpike will begin at the western terminus on Provincial Route 3, approximately 7 miles southeast of Windsor. Toll booths will be located at this point and two ramps will provide access.

The turnpike will proceed in a general north easterly direction until it crosses the primary route north of Tilbury. At this point, a partial interchange is planned, permitting access to shore points north and south.

Continuing northeast, the turnpike intersects Route 40 three miles southeast of Chatham; Route 21 two miles northeast of Ridgeton; and a primary road two miles northwest of Dutton. Partial interchanges at these three locations would adequately serve pleasure and commercial traffic originating in the Port Huron - Sarnia - London area as well as providing access to all Lake Erie resorts along the southern coast.

A full interchange will be located at a point midway between London and St. Thomas on Route 4, thereby providing ingress and egress with a minimum of interruption to the heavy Route 4 traffic.

At a point approximately seven miles southeast of London, the proposed turnpike location divides into the alternate northern and southern routes.

Continuing easterly along the southern route,

the turnpike crosses Route 74 one and one-half miles north of Belmont; Route 73 one-half mile north of Harrietsville; and Route 19 five miles northwest of Tillsonburg. A partial interchange will be located at the latter location.

Intersections with Route 24 one mile north of Waterford and Route 6 one mile southwest of Hagersville will require partial interchanges to accommodate Kitchener traffic and westbound traffic from Hamilton.

The route then curves to the northeast, crossing the Grand River and Route 54 approximately one mile northwest of Cayuga.

Swinging southeast for five and one-half miles, the turnpike interchanges at Route 3, two miles northeast of Cayuga. Route 3 crossings occur also three miles northwest of Dunnville; one-half mile northeast of Franconia; and one mile north of Wainfleet. A full interchange would be located at the latter location to serve the Niagara Falls area. Placement of the interchange at this location was necessitated by the close proximity of the Welland Canal viaduct, which will be described elsewhere in this report.

The turnpike continues easterly from the canal viaduct to a point one mile south of Stevensville, then swings southeast terminating at Route 3, approximately three miles west of Fort Erie.

Alternate Northern Route

The alternate northern route begins at a point approximately seven miles southeast of London, continuing in a northeasterly direction to the crossing at Route 19, six miles southeast of Ingersoll. A partial interchange will be provided at this point permitting access to the facility from the Stratford-Woodstock-Tillsonburg areas.

A partial interchange will be located seven miles southwest of Brantford at the intersection of Route 24. As the commercial traffic from the Kitchener area south appears heavy, provisions have been made for a full interchange at this point if traffic warrants.

The turnpike continues northeasterly, crossing the Grand River midway between Onondaga and Middleport.

In the Hamilton area, full interchanges will be located at the intersection of Route 6, three miles south of Hamilton and the crossing at Route 56, near Elfrida. The Route 6 terminal will provide convenient access to the facility for the many and varied industries of Hamilton, which has become one of the leading steel producers in Canada. The interchange at Route 56 will serve all traffic to the Toronto and lake resort areas in the north.

From this point, the turnpike continues

southeasterly until it crosses the primary road at a point five miles south of Grimsby. A partial interchange will be located at this intersection, permitting access to the beach resorts on Lake Ontario.

The area between North Pelham and Fonthill is the most rugged terrain encountered on the project. However, no problems are anticipated as all factors affecting design are well within the limits set forth in the Design Criteria.

The turnpike continues southeasterly until it crosses Route 58 approximately two miles north of Welland. A full interchange will be provided at this point to serve the Niagara Falls area.

A viaduct over the Welland Canal will permit an uninterrupted flow of traffic in contrast to the existing lift bridges and subsequent traffic tie-ups.

From here the turnpike continues to its eastern terminus at Route 3, approximately three miles west of Fort Erie.

General

The total length of the Ontario Turnpike is approximately 220 miles and it will be served by two terminal and eleven intermediate interchanges. The location of the Windsor terminal will fully utilize Route 3, which by-passes the Windsor business district

and provides a direct route to the Ambassador Bridge and Detroit. In the east, a terminal interchange at Route 3 was so located as to route traffic away from the Queen Elizabeth Way and thereby distribute the flow of traffic through customs.

The U. S. Bureau of Customs reports that during the fiscal year ending June 30, 1953, vehicles entering the United States from Canada numbered 1,739,765 at Buffalo and over 2,600,000 at Detroit.

Geographically, the Ontario Turnpike is a natural link in the interstate highway network. A glance at the regional map, Figure 4, will show that construction of this facility, coupled with the New York State Thruway, now nearing completion, would provide the most direct route now existent between Detroit and New York.

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## IV. FUTURE TRAFFIC

New highway facilities must be designed for future traffic requirements. Roadway capacities should be adequate to accommodate traffic increases likely to occur within a reasonable period of time, or provision should be made in the grading and structures for the addition of lanes as the needs develop. In the case of a toll road, such projections are even more important since they so vitally affect anticipated revenues.

For this study, traffic has been projected to 1998. It is assumed that the facility would be opened to traffic in 1958 and that its financing life would be 40 years.

Traffic growth will be a function of several related variables of which the following are basic:

1. Population trends.
2. Change in vehicle ownership ratio.
3. Change in annual usage.

Population statistics of Ontario have shown a conservative but steady growth in the last three decades. It is estimated that by 1998 the population will be 6,500,000.[1] The 1950 population was about 4,500,000.

[1]Source - Canadian Embassy, Washington, D.C.

Vehicle ownership, Figure 5, has shown a steady increase since 1930. In 1950, the last year for which accurate population figures are available, there was one vehicle for every 4.1 persons. Forty years hence, there will be an estimated 2.8 persons for every vehicle.[1] On the basis of these projections, the 1998 registration should number about 2,300,000 vehicles, Figure 5.

Annual travel is sensitive to other factors such as changes in general economy, costs of vehicle operation, governmental regulation of transportation and purpose of travel. Although most of these cannot be predicted, any one of them might alter the basic travel habits of the region.

Estimated Traffic and Revenues

Estimates of probable traffic on the proposed toll project have been derived from traffic counts taken in 1953 by the Province of Ontario. Assuming 1953 as the base year, the number of vehicles was calculated on the basis of full turnpike use. That is, the number of vehicles using only part of a toll road between interchanges was reduced to the equivalent of full turnpike use.

Since the toll road would require three years to complete, 1958 was assumed as the first year of

[1] Source - Canadian Automobile Chamber of Commerce

operation, and it was conservatively assumed that traffic in 1958 would exceed that of 1953 by fifteen per cent. Additional increases in traffic were forecast for subsequent years, though at successively lower rates of increase (Table 1). This growth of traffic results from two factors: (1) more vehicles on the road, and (2) greater popularity of the toll facility. Ordinarily, it requires several years for a turnpike to reach its potential usefulness. It was further estimated that trucks would represent about twenty per cent of all vehicles as they do on the Pennsylvania Turnpike.

Tolls have been figured on the basis of 1.2 cents a mile for passenger cars and 4.8 cents a mile for trucks. These charges correspond closely to those found on the Pennsylvania Turnpike, but are slightly less than those in force on the New Jersey Turnpike. Average revenue per vehicle routed on the Pennsylvania facility is 1.92 cents; on the New Jersey road, 2.15 cents.

Revenues from concessions were calculated at 7.5% of toll revenues, which corresponds to the experience of the Pennsylvania and New Jersey Turnpikes.

(Page 30 follows)

[illegible]

[illegible]

[illegible]

[illegible]

ESTIMATED RESULTS OF OPERATION - FIRST TEN YEARS

| r. | No. of Vehicles | Revenue From Tolls | Revenue from Concessions | Total Revenues | Oper. Expense | Balance for Debt |
|---|---|---|---|---|---|---|
| 958 | 2,308,625 | 10,316,943 | 773,771 | 11,090,714 | 2,200,000 | 8,890,71 |
| 959 | 2,585,660 | 11,554,976 | 866,623 | 12,421,599 | 2,200,000 | 10,221,59 |
| 960 | 2,844,226 | 12,710,474 | 953,286 | 13,663,760 | 2,200,000 | 11,463,76 |
| 961 | 3,071,764 | 13,727,312 | 1,029,548 | 14,756,860 | 2,200,000 | 12,556,86 |
| 962 | 3,256,070 | 14,550,951 | 1,091,321 | 15,642,272 | 2,200,000 | 13,442,27 |
| 963 | 3,418,874 | 15,278,499 | 1,145,887 | 16,424,386 | 2,200,000 | 14,224,38 |
| 964 | 3,555,629 | 15,889,639 | 1,191,723 | 17,081,362 | 2,200,000 | 14,881,36 |
| 965 | 3,697,854 | 16,525,225 | 1,239,392 | 17,764,617 | 2,200,000 | 15,564,61 |
| 966 | 3,808,790 | 17,020,982 | 1,276,574 | 18,297,556 | 2,200,000 | 16,097,55 |
| 967 | 3,923,054 | 17,531,611 | 1,314,871 | 18,846,482 | 2,200,000 | 16,646,48 |

It will be noted that no increase in operating expenses has been assumed in the above calculation. This comes about for two reasons: (1) Maintenance costs on a new road do not rise markedly during the first ten years of operation; and (2) costs of collecting tolls either do not increase with traffic or increase only slightly. But even if operating expenses should rise gradually, revenues would still exceed expense by a wide margin. It is worth pointing out that estimates of traffic, hence of revenues, are conservative, and deliberately so. In the cases of other turnpikes, actual traffic figures have far exceeded earlier estimates by which financial feasibility was determined.

TABLE 1. ESTIMATED TRAFFIC FOR FIRST TEN YEARS OF OPERATION

NUMBER OF VEHICLES PER YEAR

| Year | No. Vehicles | % Increase in Traffic |
|---|---|---|
| 1953 | 2,007,500 | |
| 1958 | 2,308,625 | 15 |
| 1959 | 2,585,660 | 12 |
| 1960 | 2,844,226 | 10 |
| 1961 | 3,071,764 | 8 |
| 1962 | 3,256,070 | 6 |
| 1963 | 3,418,874 | 5 |
| 1964 | 3,555,629 | 4 |
| 1965 | 3,697,854 | 4 |
| 1966 | 3,808,790 | 3 |
| 1967 | 3,923,054 | 3 |

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## AMORTIZATION OF THE TOLL PROJECTS

The financing program calls for the issuance of $152,381,000 in bonds, at an average rate of interest of four (4) per cent. To this percentage, a safety factor of fifty (50) per cent has been added to take care of contingencies. Under these assumptions, the schedule of debt service can be projected as shown below:

(page 32 follows)

ESTIMATED DEBT SERVICE SCHEDULE, 1958 - 1967

| ear | Bal.Available for Debt Serv. | Interest on Debt (4%) | Safety Fact. (50% of Int.) | Available for Amortization | Balance of Bonded Debt |
|---|---|---|---|---|---|
| 958 | 8,890,714 | 6,095,240 | 2,795,474* | - | 152,381,000 |
| 959 | 10,221,599 | 6,095,240 | 3,047,620 | 1,078,739 | 151,302,261 |
| 960 | 11,463,760 | 6,052,090 | 3,026,045 | 2,385,625 | 149,916,636 |
| 961 | 12,556,860 | 5,996,665 | 2,998,333 | 3,561,862 | 146,354,774 |
| 962 | 13,442,272 | 5,854,191 | 2,927,096 | 4,660,985 | 141,693,789 |
| 963 | 14,224,386 | 5,667,752 | 2,833,876 | 5,722,758 | 135,971,031 |
| 964 | 14,881,362 | 5,438,841 | 2,719,421 | 6,723,100 | 129,247,931 |
| 965 | 15,564,617 | 5,169,917 | 2,584,959 | 7,809,741 | 121,438,190 |
| 966 | 16,097,556 | 4,857,528 | 2,428,764 | 8,811,264 | 112,626,926 |
| 967 | 16,646,482 | 4,505,077 | 2,252,539 | 9,888,866 | 102,738,060 |

* Represents 46% Safety Factor (first year only)

The estimate is that at the end of ten years the unamortized debt on these toll projects would have been reduced to the point that another ten years of operation would permit its complete extinction. Though this result appears optimistic, it accords with the results of operation to date on the New Jersey Turnpike and the post-war financial reports of the Pennsylvania Turnpike.

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## V. DESCRIPTION OF THE TURNPIKE

### Roadway

A typical cross section of the proposed roadway is shown in Figure 6. This cross section was selected on the basis of careful study and consideration of the following factors: safety, economy, convenience to the driver and ease of maintenance.

The turnpike will consist of two lanes of pavement 24 feet wide, separated by a median strip approximately 50 feet wide. This minimum width will be maintained throughout the length of the turnpike. Where streams, roads or railroads are overpassed by the turnpike, the northbound and southbound lanes will be carried by two separate bridges about 50 feet apart.

The two pavement lanes will be paved either with a reinforced Portland cement concrete pavement or with a flexible type of pavement consisting of a macadam base, with an asphalt concrete surface. Either type of pavement will be 24 feet wide in each traffic direction and will be supported by an 8 inch to 12 inch thick layer of selected subbase material. Thickness of this material will vary with the characteristics of the supporting soils or rock formations. This heavy-duty pavement will not require major maintenance or reconstruction for twenty to thirty years. In selection

of the pavement type, all relevant facts will be studied, including initial cost, annual maintenance cost, and local conditions, so that the type selected will best meet the needs of users.

Shoulders will be 12 feet wide adjacent to the outside lanes, and 3 feet wide adjacent to the inside lanes. In both cases, shoulders will be constructed of crushed stone or gravel, or other suitable stabilized material. Shoulder design and specifications are directly related to the safety and convenience of the turnpike user.

A shoulder 12 feet wide adjacent to the outside lane of the turnpike will provide ample room for disabled trucks. Truck drivers may rest or perform minor repairs in full safety, without interfering with fast moving turnpike traffic.

Reflectorized delineators will contribute to night-driving safety, and sturdy metal-beam guard rail will be installed at shoulder edges along all fills more than 10 feet high to safeguard out-of-control vehicles.

Sloping shoulders will efficiently drain the turnpike. In the depressed median, this slope will continue to the turnpike centerline, where accumulated runoff will periodically be carried away by underground crossdrains.

The typical sectiin described above was used with the preliminary profiles, grades, and alignment to estimate turnpike construction quantities. Where necessary for slope stabilization, appropriate benching will be provided.

Drainage

There are three main aspects of turnpike drainage design. The first concerns stream crossings, including natural drainage channels with intermittent flow. Secondly, drainage design provides for the removal of storm water from the surface of the turnpike and from its side slopes. Finally, ground water levels are controlled to insure stability of the turnpike foundation, thereby eliminating the prime cause of pavement cracking and deterioration. Costly maintenance is avoided by proper attention to these matters in both design and construction.

The type of structure used to provide for cross drainage varies with the size of the drainage area above the point of intersection with the turnpike alignment. For the larger streams and rivers, bridges of various types will be designed. These will normally be of reinforced concrete or stell construction. For the smaller areas, pipe culverts, box culverts, or arch culverts will be used, with 18" pipe culverts serving

the smallest areas. The required pipe size increases with drainage area until economic factors dictate the use of a box or arch culvert structure.

In some cases, conservative design will require permanent-type box structures where pipe culverts would normally be within the range of feasibility. In locations where washouts are anticipated, preventive measures will be taken. These measures may include relocation of the stream channel or special protection for the fill slopes of the turnpike roadway. Adequate safety factors will be used in culvert design for drainage areas of all sizes to assure that structures provided will not be overloaded.

To this end, 25-year storm frequency will be used in design of drainage structures.

Surface drainage will be handled by open ditches and inlets, as required.

Where ground water or seepage are encountered the underdrainage system will insure subgrade stability at all times and in all seasons.

Surface drainage from the turnpike and its backslopes will be concentrated in two places. Median strip runoff will drain off at the centerline. The rest of the runoff from the pavement and from the back-slopes of cuts will drain to the turnpike shoulder ditches.

The water collected in these channels will be periodically relieved by cross drains under the turnpike emptying into longitudinal open ditches, storm sewers, or natural watercourses.

Cross drains will be spaced at frequent intervals to provide fast removal of all surface runoff. Where the turnpike is in fill, the cross drains will be relieved on the surface of the fill itself, protection being provided where necessary. When required, open ditches will be provided at the top of cut slopes to intercept surface runoff from areas beyond the graded roadway; slopes subject to erosion are thereby protected.

Likewise, ditches will be provided at the bottom of fill slopes to prevent erosion damage to the turnpike.

The control of ground water and seepage will be accomplished through the special subgrade material and the underdrainage system. This water will be carried under the turnpike through the special subgrade material, or in special cases, through cross drains where it will flow into an open ditch, the open fill slopes, or special longitudinal subdrains. In some cases, these longitudinal underdrains will be combined drains carrying off surface drainage as well. The design of the underdrainage system will be such as to keep the

ground water table a sufficient distance below the surface of the pavement to insure subgrade stability at all times and seasons.

Drainage estimates for the turnpike were prepared on the basis of the above policies and design. Materials used for drainage structures will be appropriate to the individual structures concerned; they will necessarily vary with height of fill, size of drainage area, characteristics of the water being drained, and other factors.

Interchanges

In addition to the two termini, eleven intermediate interchanges will be provided at strategic points along the route. A typical full interchange is shown in Figure 7.

Two conflicting considerations influence the number of interchange locations. First, it is desirable to hold the number of interchanges to a minimum to reduce friction between entering traffic streams and through traffic streams. This is one of the major advantages of a limited access highway. Secondly, it is necessary to distribute and collect all traffic at origins and destinations within a reasonable distance of the turnpike. The locations selected are a reasonable compromise of these two considerations based

on a detailed study of existing traffic patterns within the area.

These locations are shown on Figure 10 of this report. Turnpike interchanges will be designed to provide safe, quick ingress and egress from the turnpike without interference from cross traffic and left hand turns. Equally important, the through traffic on the turnpike will not be interrupted. Interchanges will be laid out and designed geometrically to take full advantage of natural topographic features; economy and safety will be emphasized. Final grades and degree of curvature will be analyzed in great detail.

Modern lighting installations at interchange areas will contribute to driver comfort and safety at night.

A minor but important consideration in the operation of a turnpike facility is the number, type and clarity of directional signs in the area of, and approaches to, the turnpike interchanges. This is a small item cost-wise, but one which contributes greatly to the convenience of the using motorist.

Structures

All existing railroads and highway intersecting the turnpike alignment will be either underpassed or overpassed. Bridge structures will be of reinforced

concrete or steel as design conditions dictate. Bridge spans, clearances, and other design features will be subject to the approval of Provincial or local authorities, whichever is appropriate. In the case of railroads, the requirements for future extra tracks will be foreseen to eliminate later interference to turnpike traffic by such construction. Likewise, spans of roadway bridges will make allowance for future improvements, especially where existing roads are inadequate. Considering both architectural and engineering factors, they will use simple harmonious lines to yield maximum esthetic effect at minimum cost. See Figure 8.

The structures will accommodate the heaviest modern highway loadings, thus providing for all reasonable future requirements. The loading designated as H20-S16 (modified) has been adopted. This loading will take care of any reasonable number of 20-ton trucks with trailers, having 32,000 lb. axle loads, together with all legal loadings permitted on the highways.

The Welland Canal viaduct, Figure 9, consists of a series of three-span continuous structures supported by tower piers and spanned by a monolithic concrete wearing surface. The preliminary design is based on a minimum underclearance of 165 feet and a three percent grade on either side of the canal. For a cost estimate

pile foundations have been included in the preliminary design. However, actual design conditions will dictate the extent of their usage. The value of such a high level crossing will become more and more apparent with the increase in shipping which will follow the developments of the St. Lawrence Seaway.

Occasionally farm acreage is severed by the turnpike and no convenient nearby highway or county road structure is available; the access to such areas will be provided by means of underpasses. These will be large enough to allow farm equipment, cattle, and vehicles to cross under the turnpike without interference. Property damage claims will thus be minimized.

Service Facilities

Service stations and restaurants will be spaced at convenient intervals along the length of the turnpike. They will be constructed at the expense of the oil companies or concessionaires and royalties will be collected by the Ontario Turnpike Corporation on sales of gas, oil and food.

To protect the turnpike user, standards of service and courtesy will be prescribed by the Corporation. All facilities will be modern, pleasing and serviceable. Designs for buildings will be subject to the approval of the Turnpike Corporation.

Complete facilities for refueling, lubricating, and minor maintenance will be available at all service stations.

Toll booths, service stations, and restaurants will be operated on a twenty-four hour basis every day of the year.

Architectural standards for the buildings housing these facilities will be on a consistent and pleasing standard. Nearby parking facilities connected to the buildings by covered walkways will be provided and special parking areas will be reserved for large trucks and buses.

No attempt will be made to provide overnight sleeping accommodations for turnpike motorists. It will be the policy of the Corporation to provide only those services which are essential to the needs of the motorist, and leave the maximum possible number of products and service to be furnished by private organizations.

Service facilities will be located and arranged as to provide ingress and egress with a minimum of interruption to the through traffic on the turnpike. They will be provided with ample and clearly worded warning signs so that motorists will be advised when they are approaching the facilities.

Maintenance Facilities

One of the most important operations contributing to the long term success of a turnpike project is that of maintenance. Adequate maintenance procedures, equipment, and personnel are absolutely essential to insure that the turnpike will at all times offer a maximum of safety and convenience to the user.

To insure proper maintenance on a long-term basis, funds will be provided by the original bond issue to construct maintenance buildings at intervals along the turnpike. These buildings will be designed specifically for the purpose for which they are to be used; they will be neat, modern, and efficient.

Careful planning and proper organization of maintenance personnel, will keep small maintenance problems from becoming major difficulties. Emphasis will be on preventive maintenance and a minimum of interference to turnpike traffic.

Toll Collection

Tolls will be collected on the alternate southern route at the following thirteen points:

1. Windsor interchange at Route 3.
2. Tilburn interchange at Route 2.
3. Chatham interchange at Route 40;
4. Ridgeton interchange at Route 21.

5. Dutton interchange at Route 75.
6. London-St.Thomas interchange at Route 4.
7. Tillsonburg interchange at Route 19.
8. Waterford interchange at Route 24.
9. Hagersville interchange at Route 6.
10. Cayuga interchange at Route 3.
11. Dunnville interchange at Route 3.
12. Welland-Niagara Falls interchange at Route 3.
13. Ft. Erie interchange at Route 3.

Collections on the alternate northern route will be made at the following locations:

1-6. Same as above.
7. Tillsonburg-Ingersoll interchange at Route 19.
8. Brantford interchange at Route 24.
9. Hamilton interchange at Route 6.
10. Hamilton-East interchange at Route 56.
11. Grimsby interchange (no Route No. available)
12. Welland-Niagara Falls interchange at Route 58.
13. Ft. Erie interchange at Route 3.

Tickets will be distributed and fares collected at these points. The toll buildings will be functionally and appropriately designed. They will be laid out to serve the maximum anticipated flow of traffic through the interchange, and will have all necessary service buildings as an integral part of their design. They will

have ample sight distance and easy approach grades. All necessary special accounting and tabulating equipment for the distribution of tickets and collection of tolls will be provided along with adequate communication facilities and signal devices. The ticket system used will be tamper-proof and pilfer-proof. Modern automatic business machines will record and tabulate all data and simplify accounting procedures.

Right-of-Way

The preliminary turnpike alignment has been selected with a view to providing a minimum of interference to the residential, agricultural, and industrial development of the property which it traverses. During final design, further refinements in the alignment will be made to minimize property damage. Such a policy furthers both the interests of private property owners along the turnpike and the economic self-interest of the Corporation.

The preliminary alignment shown has been used for purposes of estimating right-of-way costs. Detailed studies of property damage along this line were made in order to obtain an accurate estimate of costs.

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# VI. DESIGN CRITERIA

## Design Speed

The desirable design speed for the turnpike will be 80 miles per hour, with an absolute minimum of 70 miles per hour.

## Sight Distance

Length of vertical curves on summits shall be such as to provide a minimum sight distance of 800 feet, for a design speed of 80 miles per hour. This sight distance shall be determined by an eye level height of 4.5 feet, and an object height of 4 inches above the pavement. Lengths of vertical curves in sags shall be a minimum of 750 feet. Appropriate reductions may be made on these distances on ramps and other places where design speeds permit.

## Horizontal Curvature

The minimum radius for horizontal curves on the turnpike shall be 1,900 feet. For curves on ramps, this figure may be reduced to 150 feet.

## Grades

Where feasible, turnpike grades will be limited to 1 per cent. In no case will this figure be increased beyond 3 per cent for the turnpike proper. The maximum grades on ramps will be 5 per cent. The minimum grade for the turnpike will generally be 0.5 per cent, except

in fills and on long structures, where the grade may be perfectly horizontal.

Superelevation

Where necessary, curves will be superelevated and provided with properly designed transition curves and runouts. No arbitrary rate of superelevation is prescribed; it will be determined on the basis of the design speed, degree of curvature and frequency of icing conditions.

Traffic Lane and Shoulder Widths

There will be 12 foot traffic lanes in each direction. Shoulder widths on the inside lane will be 3 feet, and on the outside lane 12 feet.

Acceleration and deceleration lanes will be 12 feet wide, and a minimum of 1,200 feet long.

Median Width

The median width will generally be 50 feet throughout the length of the turnpike. This width may be increased or decreased as necessary to make the best use of topographical conditions.

Clearances

The minimum vertical clearance for all turnpike structures will be 15 feet. The minimum horizontal clearance for turnpike structures to the right edge of the toll highway pavement will be 10 feet.

Cross Section

The cross section of the turnpike will be as shown in Figure 6. For fills over 10 feet high, a 1-1/2: 1 or 2: 1 slope with a guardrail will be used. Design in this matter will depend upon the type of material available for fill. For fills less than 10 feet high a 4:1 slope without guardrail will be used. In cuts, slopes will vary with the material from 1-1/2: 1 in rock to 2: 1 in earth cuts 10 feet or less in depth. Tops of cuts and fill slopes will be rounded. Where necessary for slope stabilization, appropriate benching will be used. Along both sides of the entire route a continuous animal-proof woven-wire fence will prevent accidental entry of livestock and game onto the roadway. Unauthorized vehicles are excluded and trespassing is thereby discouraged.

Signs and Markings

The turnpike will be well marked with reflectorized roadway striping, regularly-spaced high-visibility reflector-type delineators, directional signs, and other necessary markers. No billboards, lighted neon signs, or other confusing and distracting signs will be allowed within the right-of-way.

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## VII. CONSTRUCTION PROGRAM

To minimize the bond interest falling due during the construction period, and to permit production of revenue as promptly as possible, the turnpike construction stages will be carefully programmed beforehand to insure maximum speed. A large number of contractors will work simultaneously, each type of work geared into the overall pattern, so that as the portion of the work handled by each group of contractors is finished, the remaining parts will be either ready for the next operation or completion. This type of construction program has been successfully utilized on numerous recent turnpike projects.

The overall time required for construction is estimated at 36 months.

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## VIII. CONSTRUCTION COST

Individual construction items were studied and analyzed in preparing the construction cost estimate. The resulting unit prices are tabulated on the following page.

It is believed that this tabulation represents a reliable basis for estimating turnpike construction costs. Every possible source of data has been used in preparing it. Various individuals and manufacturers have been contacted in arriving at costs of labor, equipment and personnel. In addition, our own extensive turnpike engineering experience was supplemented by up-to-date construction cost data for New York Thruway and four-lane highway projects in the Buffalo area. All assembled data were evaluated and adjusted to the end that the schedule of unit costs would represent a fair estimate.

The construction cost estimate which follows immediately after the Unit Price Schedule is based on multiplication of unit prices by the stimated quantities. These quantities were determined by application of the design criteria and construction principles outlined in the preceding section of this report. These criteria and principles have been developed in sufficient detail to permit the mathematical computation of reasonable project quantities.

Earthwork estimates used in this report are based on careful thorough examination and correlation of all existing data, including information secured from study of Canadian Geological Survey maps covering the entire route of the turnpike. When construction plans are prepared, a detailed engineering survey will provide for greater precision in earthwork quantity estimates, but experience has shown that final figures confirm the validity of preliminary estimates prepared from data of the type utilized herein. The order of magnitude of the differences in estimates is not such as to jeopardize the feasibility of the overall project.

Estimates herein are conservative throughout, and full benefit has been extracted from the engineering experiences of other turnpikes recently built, for which this organization has executed many miles of both preliminary and final construction plans.

UNIT PRICE SCHEDULE

| DESCRIPTION | UNIT | UNIT PRICE |
|---|---|---|
| Clearing and Grubbing | Acre | $ 250.00 |
| Embankment in place | Cu.Yd. | 0.60 |
| Channel Excavation | Cu.Yrd. | 0.90 |
| Structural Excavation | Cu.Yd. | 3.00 |
| Overhaul | Sta.Yds. | 0.01 |
| Topsoil Dressing | Sq.Yrd. | 0.20 |
| Water for Grassing | M.Gal. | 2.50 |
| Flexible Base (Crushed Aggregate) | Cu.Yd. | 2.60 |
| Foundation course (Sub-base) | Cu.Yd. | 0.90 |
| Hot-mix Asphaltic Concrete Pavement | Ton | 10.75 |

[illegible] estimates used in this report are
based on careful thorough examination and correlation
[illegible]
from study of Canadian Geological Survey maps covering
the entire range of the formations. When [illegible]
[illegible] are prepared, a [illegible] survey will
[illegible]
estimates, but experience has shown that first figures
are on the [illegible] of preliminary estimates, prepared
from data of the type utilized herein. The order of
magnitude of the differences in estimates is not such
as to jeopardize the feasibility of [illegible] project.
[illegible]
and full benefit has been extracted from the [illegible]
[illegible]
the organization may [illegible] more values of [illegible]
[illegible] and final [illegible]

[illegible]

| | | | |
|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] |
| Overburden [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |

| DESCRIPTION | UNIT | UNIT PRICE |
|---|---|---|
| Cement Concrete Pavement | Sq.Yd. | 5.00 |
| Concrete for Structures, Class A | Cu.Yd. | 56.00 |
| Concrete for Structures, Class B. | Cu.Yrd. | 35.00 |
| Reinforcing Steel | Lb. | 0.12 |
| Structural Steel | Lb. | 0.14 |
| Reinforced Concrete Pipe, 18" Diameter | Lin.Ft. | 6.00 |
| Reinforced Concrete Pipe, 24" Diameter | Lin.Ft. | 8.25 |
| Reinforced Concrete Pipe, 36" Diameter | Lin.Ft. | 14.25 |
| Reinforced Concrete Pipe, 48" Diameter | Lin.Ft. | 24.50 |
| Corrugated Metal Pipe Culvert, 18" Diameter | Lin.Ft. | 5.70 |
| Corrugated Metal Pipe Culvert, 36" Diameter | Lin.Ft. | 15.25 |
| Corrugated Metal Pipe Arch Culvert,22 x 36" | Lin.Ft. | 10.00 |
| Pipe Underdrain | Lin.Ft. | 1.55 |
| Precast Concrete Piling, 14" Sq. | Lin.Ft. | 8.00 |
| Steel H Piling, 12" - 53# | Lin.Ft. | 5.25 |
| Bridge Railing | Lin.Ft. | 8.00 |
| Riprap Paving | Cu.Yd. | 34.00 |
| Inlets | Each | 375.00 |
| Manholes | Each | 300.00 |
| Concrete Ditch Pavement | Sq.Yd. | 3.00 |
| Grass Erosion Control (Broadcast Sprigging) | Sq.Yd.. | 0.05 |
| Concrete Curb | Lin.Ft. | 2.85 |
| Guard Rail (Standard) | Lin.Ft. | 3.00 |
| Right-of-Way Fence | Lin.Ft. | 1.00 |

## CONSTRUCTION COST

| ITEM | QUANTITY | UNIT | UNIT COST | TOTAL COST |
|---|---|---|---|---|
| Clearing & Grubbing | 500 | Acre | 250.00 | $ 125,000 |
| Embankment in Place | 19,910,000 | Cu.Yd. | 0.65 | 12,941,500 |
| Sprinkling | 650,000 | M.Gal. | 2.50 | 1,625,000 |
| Channel Excavation | 125,000 | Cu.Yrd. | 0.90 | 112,500 |
| Structures, stream & river crossings (99 units) | - | L.S. | - | 7,500,000 |
| Structures, grade separations, (242 units) | - | L.S. | - | 18,500,000 |
| Welland Canal Viaduct | - | L.S. | - | 12,500,000 |
| Underpasses for cattle and farm equipment | 50 | Each | 25,000.00 | 1,250,000 |
| Pavement, including base | 6,196,000 | Sq.Yd. | 5.50 | 34,078,000 |
| Interchanges, (incl. lighting, toll booths) | | | | |
| Terminals | 2 | Each | 85,000.00 | 170,000 |

CONSTRUCTION COST (cont'd)

| ITEM | QUANTITY | UNIT | UNIT COST | TOTAL COST |
|---|---|---|---|---|
| Intermediates, full | 4 | Each | 350,000.00 | 1,400,000 |
| Intermediates, partial | 7 | Each | 300,000.00 | 2,100,000 |
| Shoulders, stabilized | 3,098,000 | Sq.Yd. | 0.20 | 619,600 |
| Drainage (culverts, inlets ditches) | 220 | Mile | 10,000.00 | 2,200,000 |
| Erosion control (sodding, sprigging) | 1,000,000 | Sq.Yd. | 0.20 | 200,000 |
| Guard Rail Fence | 460,400 | L.F. | 3.00 | 1,381,200 |
| Right-of-Way Fence | 2,323,200 | L.F. | 1.00 | 2,323,200 |
| Relocation, side roads (50 miles, various types) | - | L.S. | - | 1,000,000 |
| Relocation, utilities & pipe lines | - | L.S. | - | 350,000 |
| Signs, markers & Roadway striping | | L.S. | - | 350,000 |
| Minor Construction Items | - | L.S. | - | 325,000 |

TOTAL CONSTRUCTION COST. . . .$101,051,000

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## IX. PROJECT COST

The total project cost has been estimated to include all items shown in the tabulation on the following page and encompasses all necessary costs to construct the turnpike and put it into operation.

The construction cost shown is detailed in the previous section of this report.

Preliminary costs include such items as preliminary ground surveys, preliminary feasibility reports, aerial surveys, traffic studies, and other general expense incurred prior to the sale of the bonds.

Right-of-way costs include land, buildings, property damage, and acquisition costs such as title searches and legal fees.

Legal and administrative costs include the services of necessary legal staff to initiate and carry out the construction phase of the project. It also includes administrative expenses of the Corporation itself.

Maintenance buildings and equipment includes all necessary automotive equipment, roadway maintenance equipment, and general provisions and supplies to put the turnpike corporation on an operating basis after the construction has been completed.

Communications and office equipment includes the cost of the necessary radio and telephone equipment

to permit the turnpike toll collection and maintenance facilities to function efficiently.

Engineering costs include final location surveys, core boring and soil studies, right-of-way acquisition survey, preparation of construction drawings, contract documents, contract advertisements and negotiations, general supervision of construction, field inspection, final surveys and estimates, and all necessary engineering administration required for a turnpike project.

PROJECT COST

| | |
|---|---|
| Construction Cost | $ 101,051,000 |
| Preliminary Costs | 500,000 |
| Right-of-Way & Property Damage, including Acquisition Costs | 3,500,000 |
| Legal and Administrative Costs | 750,000 |
| Maintenance Buildings & Equipment | 1,500,000 |
| Communication & Office Equipment | 400,000 |
| Policing (Buildings & Equipment) | 350,000 |
| Engineering Costs | 10,000,000 |
| Contingencies | 15,000,000 |
| SUB-TOTAL . . . . . . . | $ 133,051,000 |
| INTEREST DURING CONSTRUCTION (3 years at 4%) | 16,000,000 |
| FINANCING COSTS (2-1/2%) | 3,330,000 |
| TOTAL PROJECT COST | $ 152,381,000 |

## X. MAINTENANCE AND OPERATING COSTS

A considerable volume of data is available setting forth past experience in the maintenance and operating costs of various classes of highways, both free and toll supported.

For purposes of summarizing, maintenance expenses have been grouped in the following classifications:

Administrative:

Under this heading is included salaries and expenses of all administrative personnel such as officers, clerks, and others not directly engaged in the maintenance items listed. It includes office supplies, public relations costs, rental and housing costs for clerical staffs, and other general office expense. It also includes such reasonable fees and expenses as are payable to the Trustee under the Trust Agreement.

Maintenance

This item includes salaries, expenses, equipment rentals, and other costs pertinent to routine and preventive maintenance required to keep the turnpike in superior operating condition. Such activities include, but are not limited to, painting of traffic lines, maintaining shoulders, repairing joints, pavement patching, mowing, building and service area maintenance,

drainage system maintenance, guard rail painting, fence repair and maintenance, and lighting and communication maintenance.

Other maintenance expense items which are of infrequent occurrence such as painting of buildings and structures are also included with this item.

Toll Collection Expense

This item includes the salaries and expenses of all personnel required to operate the toll collection facilities.

Traffic Control

This item includes the salaries and expenses of such policemen as are necessary to maintain safe and efficient movement of traffic on the turnpike. Costs of police car equipment and communications are also included.

Insurance Expense

This item is set up to provide for such insurance obligations as are placed upon the corporation by the terms of the Trust Agreement.

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## XI. FEASIBILITY OF THE PROJECT

Based upon our investigation and studies as set forth in this report, it is our opinion that the proposed turnpike project is entirely feasible from an engineering standpoint. We have found no major obstacles which would affect unfavorably the construction of this facility and the conditions found are fully covered by the costs shown in our report.

The study of general soil conditions indicated the general availability of suitable foundation material. The proposed location offers unusually favorable construction conditions due to the flat terrain prevailing throughout the turnpike route.

Financially, the traffic and revenue estimates indicate that debt service requirements will be amply covered on the basis of conservative forecasts. Although only nominal traffic growth has been assumed, the entire bond issue can be retired in 20 years.

It should be mentioned, in closing, that the proposed turnpike will provide inestimable benefits to the thriving city of Toronto, and to the steel center of Hamilton.

Further, it is obvious that, even without a detailed investigation and study, there will be a considerable saving in time and distance between Detroit

and the Eastern Seaboard via the Ontario Turnpike rather than by way of existing highway facilities, turnpikes or otherwise.

Provided the acquisition of right-of-way is expedited within a reasonable time, the design and construction of the Ontario Turnpike may be completed within a three-year period.

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